

# Microwave Detection of Laser Ultrasonic for Non-Destructive Testing, Phase I

Completed Technology Project (2007 - 2008)



## Project Introduction

In this proposal, we describe a program to demonstrate the technical feasibility of a high-performance, cost-effective and robust microwave receiver for the detection of laser-generated ultrasound for NDE. Our innovative receiver is based on the integration of a microwave interferometer coupled with a pulsed laser to generate the ultrasound. By using a microwave interferometer design we will be able to overcome the limitation generally associated with classical optical receiver: 1) Inability to work in harsh environment where thermal and mechanical perturbations are present; 2) Reduction in sensitivity caused by the speckle nature of the light reflected from rough surfaces; 3) High system cost due the price of the different lasers, optics and engineering to develop an optical system working in a harsh environment and 4) high maintenance cost (Lasers and optics need to be checked, maintained and re-aligned frequently).

## Anticipated Benefits

The nondestructive testing market is large and complex, with many available techniques serving a large number of industries. According to recent market surveys, the 1997 world NDT market is on the order of \$1B. Laser/microwave ultrasonic testing fits an important niche in the metal forming, paper, glass and semiconductor manufacture, aerospace, automotive, chemical and power generation industries. Laser/microwave ultrasonic is an asset for process control, in-service inspection and post-processing in-line inspection. In process wall-thickness measurement of seamless tubing, approximately 910,000 tons of seamless tube was produced in US in year 2000. Recent study shows that if all the companies in US adopt online laser ultrasonic measurement system for process control, this would result in a saving of \$234 million annually, equivalent to 26% savings and an annual energy saving of 5%.



Microwave Detection of Laser Ultrasonic for Non-Destructive Testing, Phase I

## Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Langley Research Center (LaRC)

### Responsible Program:

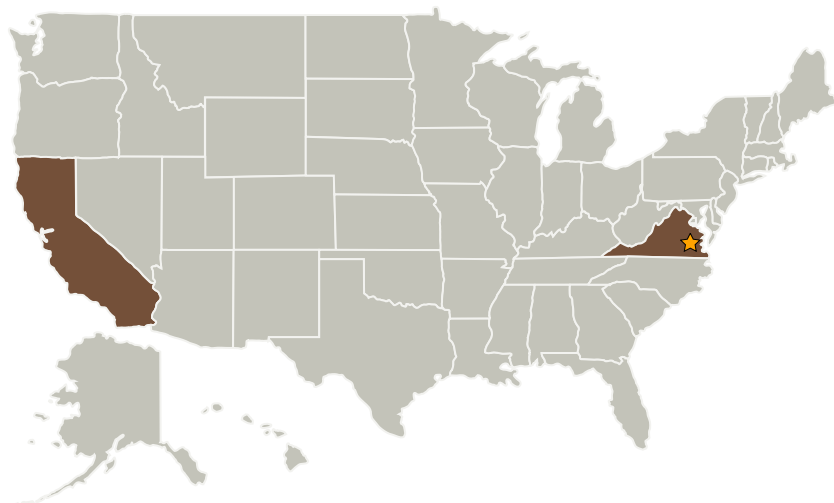
Small Business Innovation Research/Small Business Tech Transfer

Microwave Detection of Laser Ultrasonic for Non-Destructive Testing,  
Phase I

Completed Technology Project (2007 - 2008)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Langley Research Center (LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Bossa Nova Technologies, LLC	Supporting Organization	Industry	Venice, California
UCLA - Microwave Electronics Lab	Supporting Organization	Academia	LOS ANGELES, California

## Primary U.S. Work Locations

California	Virginia
------------	----------

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Project Manager:**

Eric I Madaras

**Principal Investigator:**

Sebastien Breugnot

## Technology Areas

**Primary:**

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
  - └ TX08.1.5 Lasers